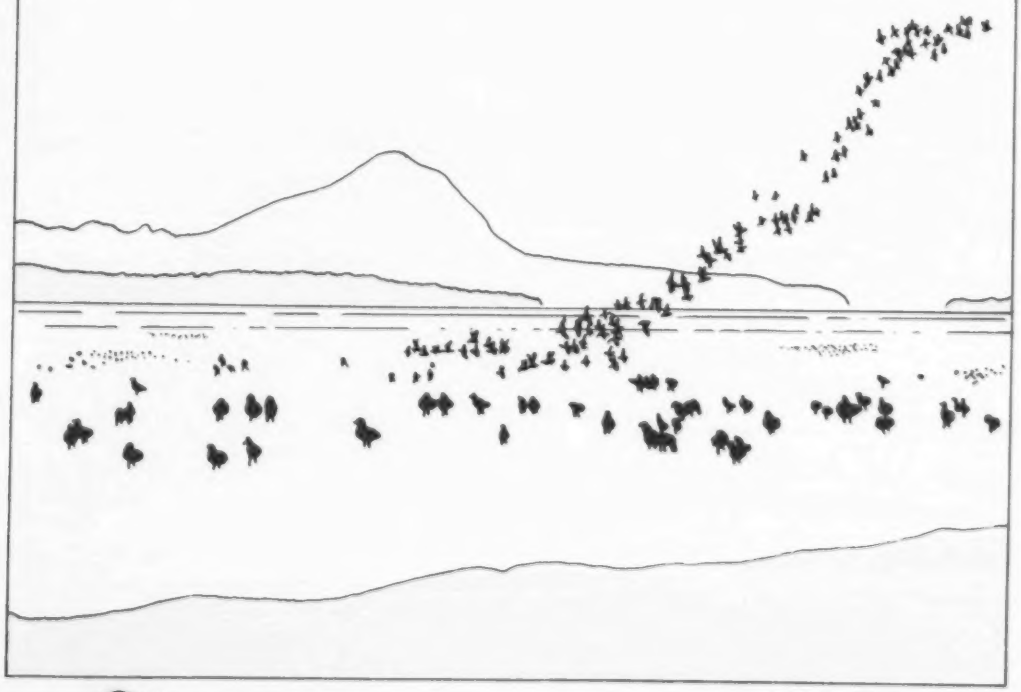
Population Estimates and Seasonal Distribution of Birds around Boundary Bay, British Columbia – Progress made to 30 April 1990



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POPULATION ESTIMATES AND SEASONAL DISTRIBUTION OF BIRDS AROUND BOUNDARY BAY, BRITISH COLUMBIA - PROGRESS MADE TO 30 APRIL 1990

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PREFACE

In August 1989, representatives for the Corporation of Delta met with counterparts from the Municipality of Surrey, and federal and provincial governments to prepare guidelines for an environmental and land-use study of lands adjacent to Boundary Bay. From that meeting arose terms of reference for a four-part study called "Human Activity and the Environment in the Boundary Bay Area" that was approved by Delta Council in April 1990. The proposed study included ecological, foreshore planning and rural land-use components. A separate study to identify environmentally sensitive areas in Surrey was added by the Municipality of Surrey.

This is the first progress report from the ecological study conducted by the Canadian Wildlife Service and British Columbia Ministry of Environment.

INTRODUCTION

Boundary Bay, at the southern edge of the Fraser River delta, is the most important bay to migratory birds on the Pacific Coast of Canada (Butler and Campbell 1987). About one million birds use the bay each year (Butler and Cannings 1989). Many of these birds are ducks and shorebirds that arrive in autumn from northern breeding grounds and remain through the winter (Vermeer and Levings 1977, Butler and Cannings 1989). In addition, the high density of raptors in the farmlands adjacent to Boundary Bay is unrivalled on the British Columbia coast. Moreover, the Lower Fraser Valley,

especially around Boundary Bay, holds the last remnant population of Common Barn-Owls in Canada.

Birds are attracted to Boundary Bay because of its mild climate, quiet resting areas and abundant food provided in extensive intertidal areas and neighbouring farmlands (Vermeer and Levings 1977, Hirst and Easthope 1981, McEwan and Whitehead 1984).

The aim of this report is to: (i) provide population estimates, (ii) examine the factors that determine the distribution of birds and, (iii) identify highly significant areas used by birds in the 'Boundary Bay ecosystem'.

THE BOUNDARY BAY ECOSYSTEM

The Boundary Bay ecosystem is defined as the former floodplain of the Fraser River delta south of the South Arm of the Fraser River and Canoe Pass, and the lowlands of the Serpentine and Nicomekl rivers (Figure 1). Excluded from the study were Westham Island, the Fraser River marshes, and Burns Bog because these areas are ecologically distinct from Boundary Bay (Butler and Campbell 1987). However, data were collected on Westham Island fields to increase our sample size of waterfowl use of different crop-types and small mammal densities in grasslands. A census of birds in Burns Bog was conducted by Terra Consultants.

A detailed description of the study area was provided by Butler and Campbell (1987). Briefly, a dike near the high-tide line of

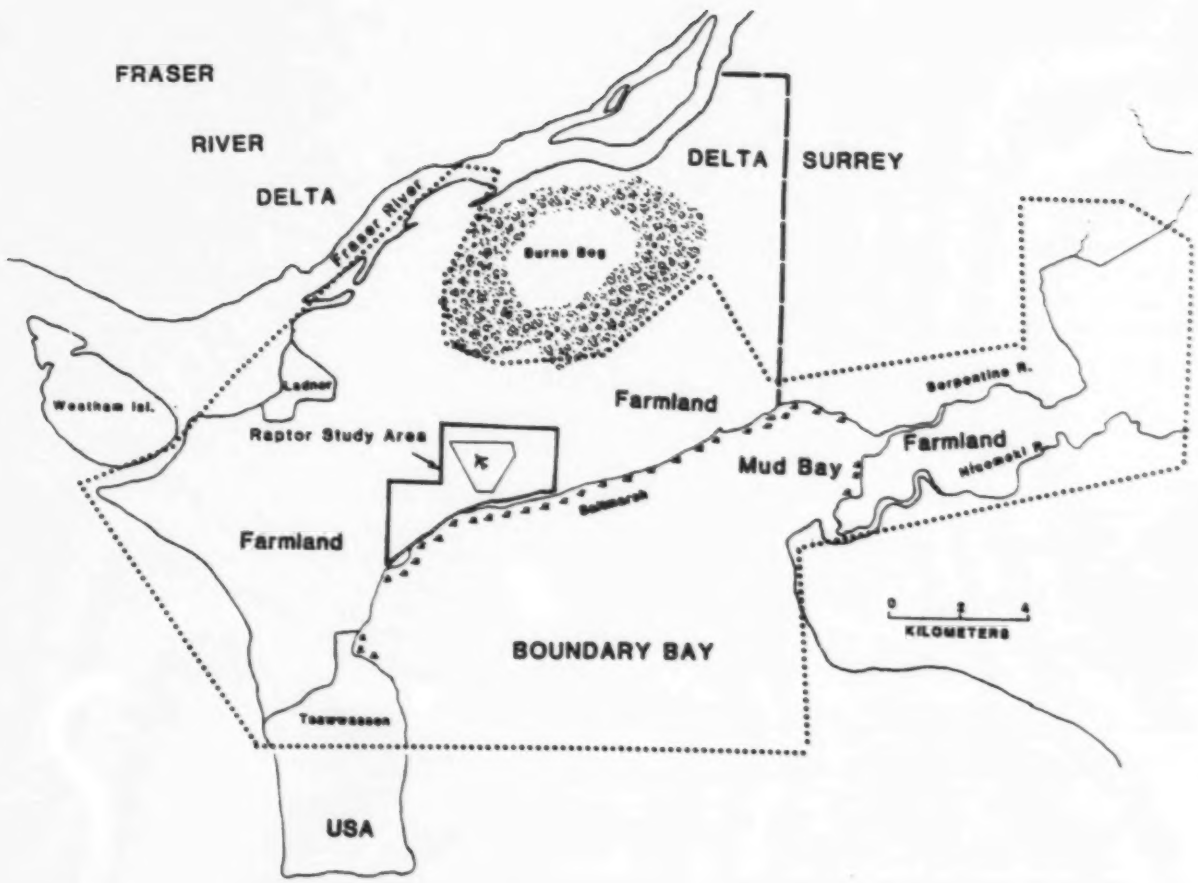

Figure 1. Boundary Bay ecosystem study area.

Boundary and Mud Bays prevents flooding of neighbouring farmlands. During very low tides all of Mud Bay and about a 2.5 kilometre wide beach in Boundary Bay, is exposed to feeding and resting birds. These beaches are mostly sandy or muddy substrates.

Most farmlands in the study area are planted in pasture, vegetable crops or left fallow. Some of these farmlands flood during heavy winter rains and attract large numbers of ducks (Hirst and Easthope 1981). Fallow fields support large populations of small mammals (Taitt and Krebs 1983) and their predators.

METHODS

1. Population estimates

Beaches - All birds were counted once each week from 15 September 1989 to 30 April 1990 in the intertidal portion of Boundary and Mud bays, which are called beaches hereafter. The beaches were divided into three parts (Figure 2) and one observer in each part simultaneously made counts through a telescope or binoculars. Each observer placed the field of view of a spotting telescope on the end of a flock and estimated the number of birds in the telescope. Then the field of view was moved to include the next group of uncounted birds in the flock. This method was repeated until the entire flock was estimated.

Farmlands - Birds were counted in farmlands both day and night each week from 15 September 1989 to 30 April 1990 along a road-side census route (Figure 2) chosen to pass by four golf courses and

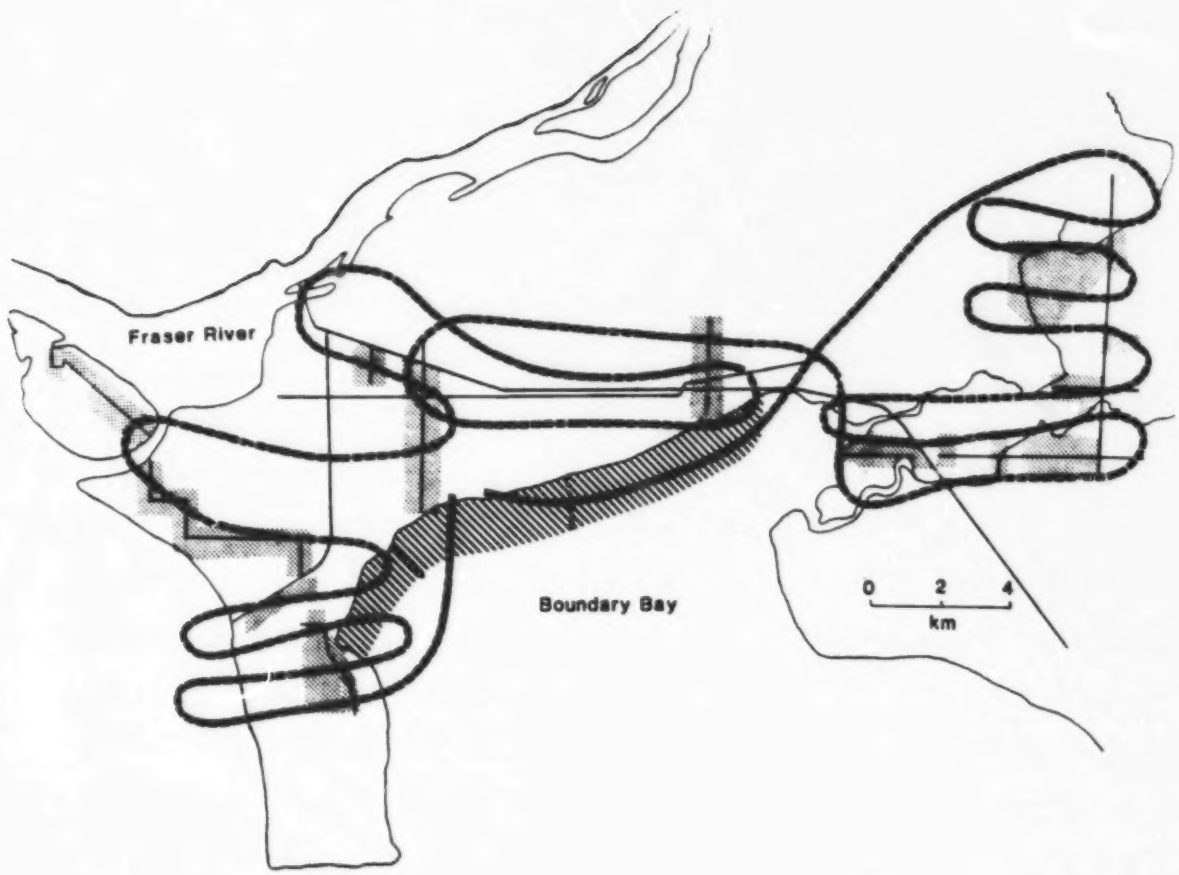

Figure 2. Roadside census route (stippled) air census route (dotted line), and bay census area (cross hatched).

about 250 fields. Night observations were aided by a Coleman 12-volt (400,000 c.p.) spotlight that illuminated fields within about 50 meters of the road.

One of us estimated the number of ducks in the entire farmlands (Figure 2) from a Cessna 172 flown at an altitude of about 150 meters on 10 occasions between 23 January and 6 April 1990.

Raptors were counted once each week from a vehicle driven along roads around the Raptor Study Area (Figure 1) from 7 November 1989 to 27 March 1990. The maximum number of each species seen on all censuses following a detectability correction factor of 2.1 for perching species (see Millsap and LeFrance 1988), was used as an estimate of the number of raptors in the Raptor Study Area.

2. Factors affecting the distribution of birds in farmlands

Field-type - The density of waterfowl and raptors was compared in fields most recently planted with potatoes, corn, leafy vegetables, pumpkins, pasture, or that were ploughed, left fallow or used as a golf course along the road-side census (see above). The relationship between raptors and field-type was further examined by comparing their distribution to the height of the grass, depth of the litter mat and relative abundance of small mammals in fields in the Raptor Study Area. Fields were categorized into one of four types depending on the height of the grass and depth of the litter mat. Sample fields of each of the four categories were then chosen for detailed analysis of vole populations. Ten plots were chosen in each sample field in which the height of the grass and the depth of

the litter mat was measured. Small mammals were live-trapped once a week in $12m^2$ grids in sample fields near the Boundary Bay Airport and on Westham Island. Traps were placed under $30cm^2$ boards and pre-baited for four weeks before trapping began. Each vole received a numbered ear tag before release. Vole abundance was estimated by counting the number of vole runways along 15 meter-long transects in each grid and relating them to the number of voles known to be present (see Taitt 1990 for detailed methods).

The distribution of raptors seen on censuses of the Raptor Study Area was then compared with the four categories of fields. A selection index for fields was determined for the Northern Harrier, Rough-legged Hawk and Red-tailed Hawk by comparing the mean (±95% confidence interval) densities of each species to the area of each field category (see Neu et al. 1974). A species with no preference will have an index of 1, while an index of less than 1 indicates a significant avoidance. An index of greater than 1 indicates a selection for that field.

3. Highly significant areas used by birds

Management techniques have been developed to increase the density of waterfowl in suitable habitats in other parts of the world. However, similar techniques are poorly developed for shorebirds and raptors. Therefore, important farmland habitats in this study were considered to be lands used by: i) 90% of all ducks during day-time surveys or flocks of over 2,000 ducks at night, ii) over 100 shorebirds during day or night and, iii) one or more

raptors on at least half the road-side censuses because there is about a 50% chance of overlooking perched raptors (Millsap and LeFrance 1988).

Scientific and vernacular names of all species mentioned in the text appear in the appendix.

RESULTS AND DISCUSSION

1. Population estimates

Beaches - The greatest number of birds counted on beaches was about 100,000 waterfowl, 50,000 shorebirds and about 100 raptors (Figure 3a,b,c). Waterfowl were most abundant on beaches in November and December, shorebirds occurred in large numbers from late November to early January, and raptors were most abundant from October to March with a peak in late February and early March.

The most abundant waterfowl species were the American Wigeon, Northern Pintail, Mallard and Green-winged Teal. Dunlin and Black-bellied Plovers predominated among the winter shorebirds and Western Sandpiper were most prevalent in late April. Among the diurnal raptors the commonly observed species on the beaches were the Bald Eagle, Northern Harrier, Rough-legged Hawk, Red-tailed Hawk and Peregrine Falcon. The Short-eared Owl, Gyrfalcon, Prairie Falcon and Merlin were seen less often.

The estimates in the present study are similar to those presented in most other studies of Boundary Bay (Jury 1981, McEwan and Whitehead 1984, Butler and Cannings 1989). Studies of waterfowl populations which were lower than ours (Vermeer and Levings 1977,

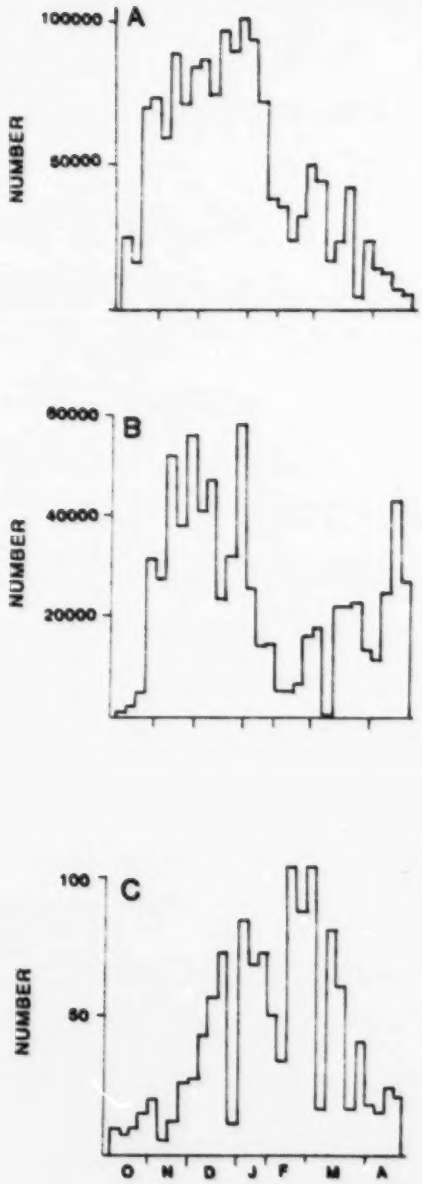

Figure 3. Numbers of waterfowl (A), sandpipers and plovers (B), and raptors (C), counted each week on beaches in Boundary Bay between October 1989 and April 1990.

McKelvey et al. 1985) were made from aircraft which grossly underestimate the actual number of birds present.

Farmlands - The maximum number of ducks seen along road censuses in farmlands was 8500 birds during the day and 16,000 at night (Figure 4a). If similar densities occurred elsewhere in the farmland then up to 27,000 ducks might have been present during the day and 48,000 at night. The greatest number of ducks seen from aircraft was 23,500. The most abundant species were the American Wigeon, Northern Pintail, and Mallard.

The daytime estimates of waterfowl in farmlands in this study are similar to those made by Jury (1981). However, his estimate of the numbers of waterfowl in farmlands at night was ten-fold greater than his estimate of use during the day. The estimate of night use in the present study was about two times the day estimates. Both night-time estimates are based on many assumptions requiring validation.

Small numbers of shorebirds were seen in fields during the day and night (Figure 4b) perhaps because they were easy to overlook. On some stormy days 50,000 Dunlin and Black-bellied Plover vacated the beaches and flew toward neighbouring farmlands where they presumably scattered into several flocks. An unknown number of both species was heard in fields at night. Fry (1980) noted that large flocks of Dunlin and Black-bellied Plover used fields on windy days.

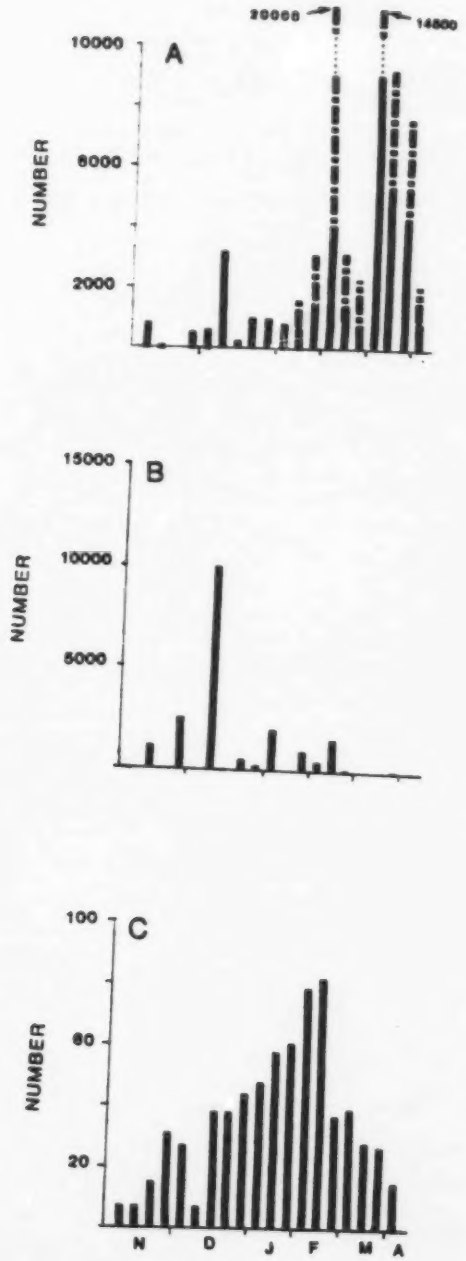

Figure 4. Numbers of waterfowl (A) counted during the day (solid bars) and night (dashed bars), and sandpipers and plovers (B) and raptors (C) during the day, on a roadside census route farmland.

Up to 80 raptors were seen on roadside censuses and many of those were Bald Eagles. In the Raptor Study Area, there were an estimated 36 Northern Harriers, 25 Rough-legged Hawks, 14 Red-tailed Hawks and 8 Short-eared Owls. J. Stroman (pers. comm.) found 30 Rough-legged Hawks, 26 Northern Harriers, 6 Red-tailed Hawks, and two Short-eared Owls between 64th and 112th Streets in February 1989. The number of raptors throughout the entire study is unknown. No estimates were made of the number of nocturnal raptors in farmlands although two Great Horned Owls and over 20 Common Barn-Owls were seen during roadside censuses. Thirty barns with Barn-Owls were found within one kilometer of habitats supporting small mammals, their principal prey (L. Andrusiak, pers. comm.). The Common Barn-Owl breeding range in Canada has eroded to a remnant population in southwestern British Columbia. Its status will probably soon change from rare to threatened on the national endangered species list.

2. Factors affecting bird distribution in farmlands

Surface-water - Much of the farmland was used by waterfowl (Figure 5) and the greatest numbers of ducks gathered where water remained on fields. It is well established that flooded farmlands are attractive to waterfowl (Hirst and Easthope 1981, Eamer 1985).

Field-type - The density of American Wigeon, Northern Pintail and Mallard was significantly ($p \leq 0.001$) different between crop types during the day. Wigeon were found in greatest density on golf courses (Figure 6a). Pintails occurred in the greatest densities in

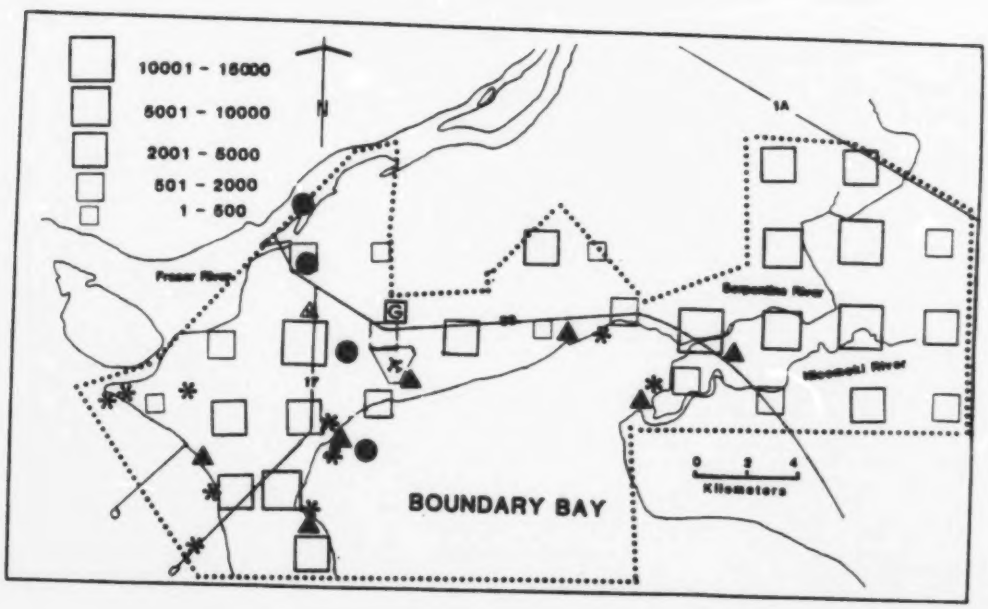

Figure 5. Day time distribution of waterfowl on 10 aerial censuses during the day between January and April (open squares), shorebirds between October and April (asterisks), gull roosts (closed dots) and Great Blue Heron roosts (closed triangles).

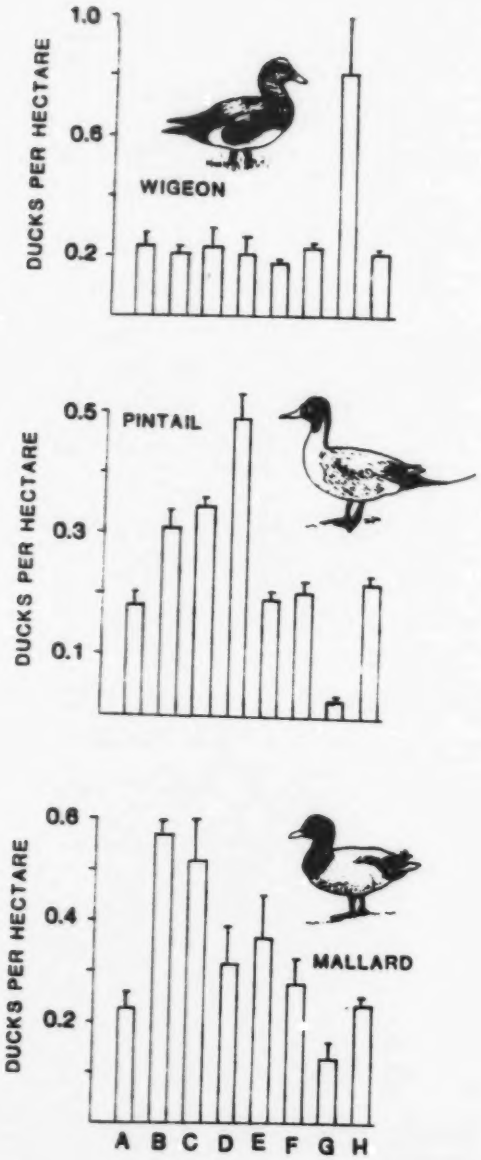

Figure 6. Density of American Wigeon, Northern Pintail, and Mallard in 7 crops and golf courses during the day. Field-types are pasture (A); potato stubble (B); corn stubble (C); ploughed, bare soil (D); leafy vegetables (E); old field and abandoned field (F); golf course (G); and discarded pumpkins (H).

ploughed fields and Mallards were most dense in potato and corn fields (Figures 6b,c).

The density of raptors was significantly correlated with the crops grown on fields ($t=2.3$, $p=0.02$). In the Raptor Study Area, the Northern Harrier and Rough-legged Hawk showed a significant ($p<0.01$) selection for old-fields and significant avoidance of turf farms (Table 1). Harriers significantly avoided abandoned (see below) farmfields and Red-tailed Hawks avoided recently-used agricultural lands (Table 1).

Table 1. Significant ($p<0.05$) selection (underlined) and avoidance (italicized) of fields by Northern Harrier, Rough-legged Hawk, Red-tailed Hawk in the Raptor Study Area.

	Species		
Field-type	Northern Harrier (n=312)	Rough-legged Hawk (n=99)	Red-tailed Hawk (n=91)
Agricultural land	0.90	0.97	*0.36*
Turf farm and pastureland	*0.44*	*0.33*	1.01
Old-field	2.10	1.85	1.61
Abandoned farmland	*0.33*	1.28	1.19

Small mammals - The greatest number of vole runways (>14 runways/15m transect) was found in abandoned fields where grasses were tall (>1m) and the litter mat was over 10cm deep. Old-fields had shorter grass (10-99cm) and a shallower litter mat (1-10cm deep) and had many voles (1-14 runways/15m transect). Agricultural lands, turf farms and pasturelands had short grass (<10cm), no litter mat and no voles were detected. Preston (1990) showed that harriers most frequently hunted fields with

abundant, easily seen vole populations in Arkansas. Thus, the significant selection of old-fields over all other field-types in our study (Table 1) probably is related to the number and detectability of small mammals to raptors. Great Blue Heron also feed on small mammals in grasslands through the autumn and winter (Taitt and Krebs 1983, R.W. Butler unpubl. data).

It is yet unclear how dependent shorebirds are on farmlands. Dunlin and Black-bellied Plover roosted and fed in farmfields but which fields are preferred is unknown.

Land-fill - Up to 20,000 gulls feed in the Delta Municipal Land-fill in winter (K. Vermeer, pers. comm.). Many of these gulls gather in large flocks in open fields to the northwest and southwest of the Land-fill site.

3. Highly significant areas for birds

The area known to be most important to ducks, shorebirds and raptors using the criteria described in the methods, is shown in Figure 7. Farmland surrounding Boundary Bay, adjacent to southern Roberts Bank, and along the Serpentine and Nicomekl rivers, is most often used by birds.

SUMMARY

Up to 100,000 ducks, 50,000 shorebirds, and about 100 raptors were counted on one day on the beaches of Boundary and Mud bays. Nearby farmlands were used by many of these birds for

food and shelter. The distribution of many species in the Boundary Bay ecosystem is closely associated with the distribution of suitable farmland habitats near Boundry and Mud Bays.

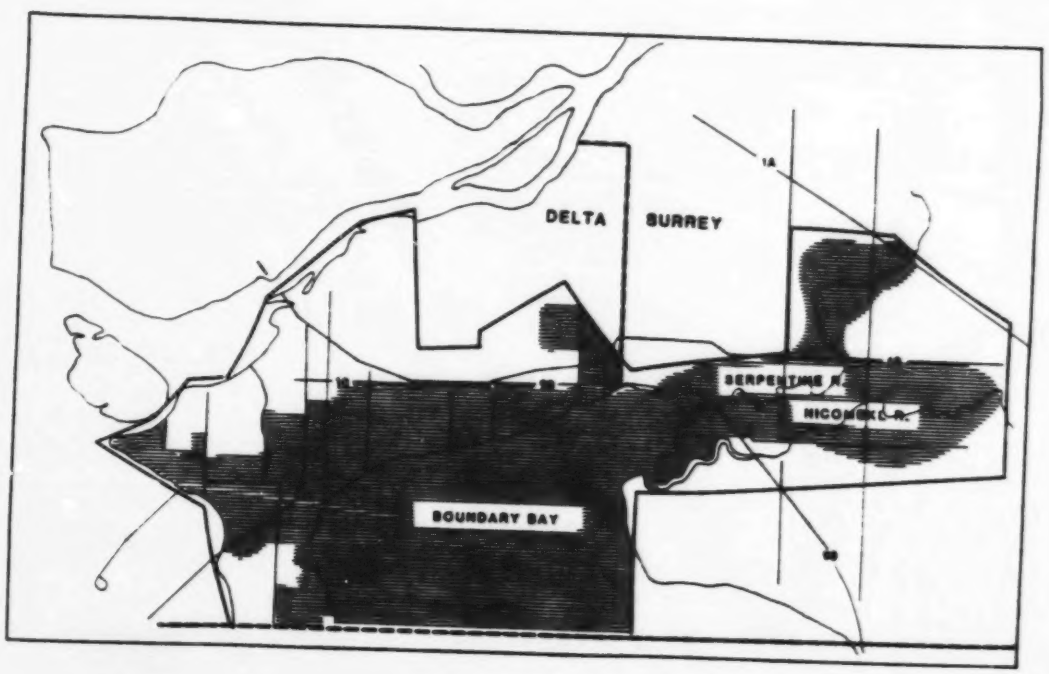

Figure 7. Important land for waterfowl, shorebirds, gulls, raptors, and herons around Boundary Bay and Mud Bay from September to June.

The second phase of this study will examine the quantity and location of lands required to support the current bird populations in the Boundary Bay ecosystem.

ACKNOWLEDGEMENTS

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Appendix. Scientific and vernacular names of all birds mentioned in the text.

Waterfowl: Ducks

American Wigeon	Anas americana
Mallard	Anas platyrhynchos
Northern Pintail	Anas acuta
Green-winged Teal	Anas crecca

Shorebirds: Sandpipers, plovers and herons

Dunlin	Calidris alpina
Black-bellied Plover	Pluvialis squatarola
Great Blue Heron	Ardea herodias

Raptors: Hawks, falcons, eagles and owls

Common Barn-Owl	Tyto alba
Short-eared Owl	Asio flammeus
Great Horned Owl	Bubo virginanus
Red-tailed Hawk	Buteo jamaicensis
Rough-legged Hawk	Buteo lagopus
Northern Harrier	Circus cyaneus
Bald Eagle	Haliaeetus leucocephalus
Gyrfalcon	Falco rusticolus
Merlin	Falco columbarius
Peregrine Falcon	Falco peregrinus